Columbus State Community College
Division: Arts and Sciences
Department: Mathematics

COURSE NUMBER: MATH 1146   **COURSE TITLE:** College Algebra Plus

INSTRUCTOR: **CONTACT:**

CREDITS: 4   **CLASS/CONTACT HOURS PER WEEK:** 6

Prerequisites: MATH 1050 with a "C" or better, or MATH 1099 (MATH 1050 Module) or by placement

DESCRIPTION OF COURSE: College Algebra Plus is a course in the study of the elementary functions. The concept of function is developed from definition and notation through an analysis of the elementary functions: linear, quadratic, absolute value, reciprocal, square root, polynomial, rational, exponential, and logarithmic, as well as piecewise, composite and inverse functions. The analysis includes function behavior with an introduction to the concepts of continuity and limits, extrema, and zeros, as well as corresponding graphical characteristics. The topic of average rate of change of a function is included. Analytic techniques include the Rational Zeros Theorem, Intermediate Value Theorem, and Conjugate Pairs Theorem, as well as factoring and transformations. The course includes solving systems of non-linear equations and partial fraction decomposition and concludes with an introduction to arithmetic and geometric sequences and partial sums. This course is designed to support and strengthen algebraic proficiency within the study of the elementary functions and emphasizes the conceptual framework of the elementary functions and the quantitative reasoning to apply them. This course meets the Ohio Department of Higher Education TMM001 Guidelines.

COURSE STUDENT LEARNING OUTCOMES:
- Determine the symmetry of various functions.
- Upon graphing functions, determine the domain and range; the intercepts; the intervals on which they increase, decrease, or are a constant; the intervals on which they are positive or negative; and the extrema.
- Determine if a function is odd, even, or neither.
- Develop a "library" of basic functions and their graphs.
- Determine the average rate of change of a polynomial function
- Find the difference quotient for elementary functions
- Sketch piecewise functions.
- Analyze piecewise functions.
- Define the absolute value function as a piecewise function.
- List the transformations, in a correct order, to be performed on a parent function to change it to a given function.
- Use geometric transformations to graph functions.

- Use geometric transformations to help in the analysis of various functions.
- Build functions as mathematical models to solve applications.
- Sketch the graphs of power functions and polynomials, locating the intercepts and extrema.
- Perform a complete analysis of power and polynomial functions.
- Relate roots, factors, and intercepts, along with discussion of multiplicity.
- Perform synthetic division of polynomials.
- Find all the zeros of a polynomial by using synthetic division, the Factor, Remainder, Rational Zeros, and Complex Conjugates theorems.
- Approximate the real zeros of a polynomial using the Intermediate Value Theorem and a graphing utility.
- Express a polynomial in completely factored form.
- Find all zeros of a polynomial (identifying them as rational, real, or non-real)
- Use transformations to graph rational functions.
- Determine the equations for vertical, horizontal, and oblique asymptotes for rational functions.
- Locate holes in the graphs of rational function.
- Sketch accurate graphs of rational functions by hand and confirm the sketch with the graphing calculator.
- Perform complete analyses of rational functions.
- Solve applications of rational functions.
- Solve polynomial and rational inequalities using a sign chart.
- Solve polynomial and rational inequalities graphically.
- Perform algebraic operations on functions.
- Form compositions of functions.
- Decompose a function into non-trivial component functions.

- Determine if a function is one-to-one.
- Verify inverse relations (algebraically and graphically).
- Determine inverses of functions.
- Analyze the exponential function in order to identify its domain, range, zeros, and asymptotes.
- Sketch the graphs of exponential functions by hand and verify using the graphing calculator.
- Solve simple exponential equations.
- Use the exponential function as a model for real life applications.
- Analyze the logarithmic function in order to identify its domain, range, zeros, and asymptotes.
- Sketch the graph of logarithmic functions by hand and verify using the graphing calculator.
- Convert exponential expressions into logarithmic expressions and vice versa.
- Explain the inverse relationship between logarithmic functions and exponential functions.
- Use the logarithmic function as a model for applications.
- Use properties of logarithms to simplify logarithmic expressions.
- Solve exponential equations algebraically and graphically.
- Solve logarithmic equations algebraically and graphically.
- Solve applications involving compound interest.
- Solve applications of exponential growth or decay.
- Solve applications involving Newton's Law of Cooling (optional topic).

- Solve 3x3 linear systems algebraically.
- Solve applications of 3X3 linear systems.
- Solve 2x2 systems of non-linear equations algebraically and graphically
- Solve applications of 2X2non-linear systems.
- Write a rational expression as the sum of partial fractions
- Find the nth term of an arithmetic sequence.
- Use sigma notation to express a partial sum.
- Find the sum of the first n terms of an arithmetic sequence.
- Determine whether a sequence is geometric.
- Find the nth term of a geometric sequence.
- Find the sum of the first n terms of an arithmetic sequence.
- Determine whether a geometric series converges or diverges.
- Determine whether a sequence is arithmetic.

PROGRAM OUTCOMES:

OUTCOMES BASED ASSESSMENT OF STUDENT LEARNING:
For this course, students are expected to demonstrate the skills associated with the Institutional Learning Goals (ILG) identified below:

      ILG #1: Critical Thinking
      ILG #3: Quantitative Skills

In class students are assessed on their achievement of these outcomes. Names will not be used when reporting results. Outcomes-based assessment is used to improve instructional planning and design and the quality of student learning throughout the college.

COURSE MATERIALS REQUIRED:

TEXTBOOK, MANUALS, REFERENCES, AND OTHER REQUIRED MATERIALS:
Required:
1. Computer with Internet Access Outside of Class
2. MATH 1146 ALEKS 360 ACCESS
3. 1.5-inch 3-Ring Binder
4. Set of 8 Tab Dividers
5. MATH-1146 COLLABORATIVE TEXT - ISBN/SKU: 9789970039401 (CSCC bookstore website https://www.cscc.edu/services/bookstore/)
6. MATH-1146 HW NOTEBOOK - ISBN/SKU: 9789970032006 or 9789970031900 (CSCC bookstore websitehttps://www.cscc.edu/services/bookstore/)
7. Scientific or Graphing Calculator (without a Computer Algebra System). Recommended calculators include the TI-30XS, TI-30XIIS, & TI-84 Plus

Recommended:

GENERAL INSTRUCTIONAL METHODS:
Instructional methods may include face-to-face or video lectures or demonstration, face-to-face or virtual discussion, individual or group activities including the use of visual aids, graphing calculators, computers and/or other technologies. Students may be expected to participate in these activities during class and/or outside of class. Instructors may require class participation, collaborative learning, and peer review.

STANDARDS AND METHODS FOR EVALUATION:
This course may include a variety of assessment methods including, but not limited or restricted to: exercises, labs, quizzes, tests, exams, and projects as deemed necessary and appropriate by the sequence committee to meet the student learning outcomes.

Grade Breakdown

Final Exam	20%
Tests	45%
In-Class Quizzes	5%
Proctored Knowledge Checks	5%
ALEKS Homework	15%
Video Lecture Quizzes	5%
In-Class Activities	5%
	100%

GRADING SCALE:
Letter grades for MATH 1146 will be based on the grade breakdown stated above using the following scale:
$\geq$ 90% - A   80-89% - B   70-79% - C   60-69% - D   < 60%: E/EN*

*An E represents a failing grade and that a significant portion of the coursework was attempted by the student. An EN represents a failing grade and that a significant portion of the coursework was not attempted by the student.

Grades will not be curved, skewed, or otherwise inflated.

SPECIAL COURSE REQUIREMENTS:
None.

ATTENDANCE/PARTICIPATION POLICY:

Each week students will earn a grade of **Participating (P) or Non-Participating (NP)**. To earn a grade of Participating for a week **ALL THREE** of the following requirements must be met:

1. Full Participation in Class 1

    - Arriving on time
    - Having completed 100% of the Edpuzzle video assignment <u>by the due date</u>
    - With 100% of the accompanying guided notes completed
    - Staying the entire class time

2. Full Participation in Class 2
    - Arriving on time
    - Having completed 100% of the Edpuzzle video assignment <u>by the due date</u>
    - With 100% of the accompanying guided notes completed
    - Staying the entire class time

3. Work actively on the week's ALEKS homework assignments in the Homework Notebook for at least six (6) hours.

All students are permitted **4 Weekly NPs** without consequence. Additionally, students are permitted **one excused P (P(EX))** in which **only one** of the three weekly requirements is missed.

If a student earns **5 or more Weekly NPs**, their final course grade is **lowered one letter grade.**

Instructors will record participation grades in Blackboard.

COLLEGE SYLLABUS STATEMENTS:
Columbus State Community College required College Syllabus Statements on College Policies and Student Support Services can be found at www.cscc.edu/syllabus or on the College website Quick Links "Syllabus Statements".

UNITS OF INSTRUCTION:
Week 1
  - Unit of Instruction: Prerequisite Preparation
  - Learning Objectives/Goals: Review necessary prerequisite topics – functions (notation, evaluation, graphing), factoring, fractions, arithmetic, linear functions
  - Assignment/Assessment Methods: online knowledge check, online homework, in-class written assignments
Week 2
  - Unit of Instruction: Prerequisite Preparation
  - Learning Objectives/Goals: Review necessary prerequisite topics – functions (notation, evaluation, graphing), factoring, fractions, arithmetic, linear functions
  - Assignment: Video lectures
  - Assessment Methods: Video lecture quizzes, online homework, in-class written assignments
Week 3
  - Unit of Instruction: Properties of Relations and Functions, Library of Parent Functions and Function Transformations
  - Learning Objectives/Goals: Determine properties of functions (symmetry, even/odd, extrema, region of increasing/decreasing, average rate of change, intercepts), review the library of parent functions (shapes, properties, domain, range, key points), determine transformations that have

been applied to a parent graph, use transformations to sketch graphs of functions whose parent graphs are in the library
- Assignment: Video lectures
- Assessment Methods: Video lecture quizzes, online homework, in-class written assignments

Week 4
- Unit of Instruction: Piecewise-Defined Functions
- Learning Objectives/Goals: Evaluate piecewise-defined functions, graph piecewise-defined functions
- Assignment: Video lectures
- Assessment Methods: Video lecture quizzes, online homework, in-class written assignments, in-class quiz

Week 5
- Unit of Instruction: Quadratic Functions
- Learning Objectives/Goals: Determine the properties of quadratic functions (vertex, zeros, direction of opening), solve quadratic equations, sketch graphs of quadratic functions, determine the equation of a quadratic function from its graph, solve problems involving quadratic functions, build functions as mathematical models to solve application problems
- Assignment: Video lectures
- Assessment Methods: Video lecture quizzes, online homework, in-class written assignments, in-class quiz

Week 6
- Unit of Instruction:
- Learning Objectives/Goals: Test Review and Preparation
- Assignment/Assessment Methods: Online homework, in-class written assignments, test

Week 7
- Unit of Instruction: Introduction to Polynomial Functions
- Learning Objectives/Goals: Determine properties of polynomial functions (intercepts, multiplicity, zeros, factors, turning points, end behavior, domain, range), identify polynomial functions from an equation and a graph
- Assignment: Video lectures
- Assessment Methods: Online knowledge check, video lecture quizzes, online homework, in-class written assignments

Week 8
- Unit of Instruction: Zeros of Polynomial Functions, Rational Functions
- Learning Objectives/Goals: Determine zeros of polynomial functions, solve polynomial equations, form polynomial functions with given zeros, determine properties of rational functions (domain, range, asymptotes, holes, intercepts, end behavior), sketch graphs of rational functions
- Assignment: Video lectures
- Assessment Methods: Video lecture quizzes, online homework, in-class written assignments, in-class quiz

Week 9
- Unit of Instruction: Polynomial and Rational Inequalities
- Learning Objectives/Goals: Solve polynomial inequalities, solve rational inequalities
- Assignment: Video lectures
- Assessment Methods: Video lecture quizzes, online homework, in-class written assignments

Week 10
  - Unit of Instruction: Composite, One-to-One, and Inverse Functions
  - Learning Objectives/Goals: Form composite functions, evaluate composite functions, determine whether a function is one-to-one, form inverse functions, evaluate inverse functions
  - Assignment: Video lectures
  - Assessment Methods: Video lecture quizzes, online homework, in-class written assignments, in-class quiz
Week 11
  - Unit of Instruction:
  - Learning Objectives/Goals: Test Review and Preparation
  - Assignment/Assessment Methods: online homework, in-class written assignments, test, online knowledge check
Week 12
  - Unit of Instruction: Exponential Functions, Logarithmic Functions
  - Learning Objectives/Goals: Evaluate exponential functions, determine properties of exponential functions (domain, range, shape, intercepts, asymptote), sketch graphs of exponential functions, solve exponential equations, evaluate logarithmic functions, simplify logarithmic expressions, determine properties of logarithmic functions (domain, range, shape, intercepts, asymptote), sketch graphs of logarithmic functions, solve logarithmic equations
  - Assignment: Video lectures
  - Assessment Methods: Video lecture quizzes, online homework, in-class written assignments
Week 13
  - Unit of Instruction: Exponential and Logarithmic Equations, Applications of Exponential Functions
  - Learning Objectives/Goals: Solve exponential and logarithmic equations, simplify logarithmic expressions, solve application problems involving exponential and logarithmic functions
  - Assignment: Video lectures
  - Assessment Methods: Video lecture quizzes, online homework, in-class written assignments

Week 14
  - Unit of Instruction: Solving Systems of Linear and Nonlinear Equations
  - Learning Objectives/Goals: Solve 3x3 systems of linear equations, solve systems of nonlinear equations, solve application problems involving systems of equations
  - Assignment: Video lectures
  - Assessment Methods: Video lecture quizzes, online homework, in-class written assignments

Week 15
  - Unit of Instruction:
  - Learning Objectives/Goals: Test Review and Preparation
  - Assignment/Assessment Methods: online homework, in-class written assignments, test